Material based on a non-woven textile sheet (mat) which can be used as strengthening reinforcement for waterproof coverings

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The material can be used as strengthening reinforcement of bituminous waterproof coverings, which material is of the type consistuted by a non-woven fibrous sheet (mat). It is characterised in that the said sheet (mat) is formed from a complex which includes three superposed layers of fibres, bonded to each other, the external layers being based on discontinuous glass fibres and the intermediate layer being constituted by a polyester non-woven, the assembly of the layers thus combined being bonded chemically by means of an adhesive material which is compatible with bitumen.

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(54) Matériau à base d'une nappe textile non tissée utilisable comme armature de renforcement de revêtements d'étanchéité.

(57) Matériau utilisable comme armature de renforcement de revêtements d'étanchéité bitumineux, matériau du type constitué par une nappe fibreuse non tissée.

Il se *caractérise* par le fait que ladite nappe est formée d'un complexe comportant trois couches de fibres superposées, liées entre elles, les couches externes étant à base de fibres de verre discontinues et la couche intermédiaire étant constituée par un non-tissé en polyester, l'ensemble des couches ainsi associées étant lié chimiquement par une matière collante compatible avec le bitume.

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La présente invention concerne un nouveau type de matériau à base d'une nappe textile non tissée utilisable comme armature de renforcement de revêtements d'étanchéité, notamment à base de bitume.

Les revêtements d'étanchéité à base de bitume renforcés par une structure textile sont connus depuis fort longtemps.

Le plus ancien est celui qui avait été utilisé par Noé pour construire son arche.

En effet, ainsi que cela ressort clairement de l'Ancien Testament, Genèse-Verset 14, avant le déluge Yahvé dit à Noé : *Fais-toi une arche en bois résineux, tu la feras en roseaux et tu l'enduiras de bitume en-dedans et en-dehors*".

Ainsi, il ressort clairement de cette description que des matériaux étanches à base de bitume renforcé par une structure servant de support était connue.

Depuis cette époque, de tels matériaux n'ont cessé d'être utilisés, notamment pour réaliser la couverture de bâtiments. Les armatures de renforcement ont bien évidemment évolué en même temps que de nouvelles matières textiles et/ou structures à base de ces matières apparaissaient sur le marché.

Ainsi, il a été proposé d'utiliser comme armatures de renforcement des feutres à base de fibres de verre, des structures tissées ou non (FR-A-1 330 291, 1 391 454) voire même réaliser des complexes non tissés/tissus dans lesquels les différentes couches sont liées entre elles par des coutures (US-A-3 044 146) et/ou d'associer des nappes à base de matière textile différente par exemple un non-tissé polyester et un voile de fibres de verre.

Toutes les propositions faites à ce jour ne permettent

cependant pas d'obtenir de manière économique, à grande vitesse, un complexe fibreux qui soit facile à manipuler et à stocker et qui présente l'ensemble des qualités exigées lorsque l'on désire réaliser un revêtement d'étanchéité monocouche à savoir de très bonnes propriétés mécaniques, une stabilité dimensionnelle et une excellente résistance aux poinçonnements tant statique que dynamique.

Le matériau le plus approprié pour remplir toutes ces caractéristiques est, à ce jour, constitué par un complexe formé d'un non-tissé en polyester associé sur l'une de ses faces avec une grille textile en verre. Un tel complexe est commercialisé par le Demandeur sous la référence 603 GP 70.

Il donne de très bons résultats mais nécessite des installations complexes pour le réaliser.

Or on a trouvé, et c'est ce qui fait l'objet de la présente invention, un nouveau type de complexe fibreux qui, non seulement permet d'obtenir les caractéristiques souhaitées pour des revêtements d'étanchéité à base de bitume et plus particulièrement les revêtements monocouches mais qui, par ailleurs, peut être produit à grande vitesse, est facile à stocker et manipuler, présente une très grande stabilité dimensionnelle, et présente une excellente résistance aux poinçonnements.

D'une manière générale, l'invention concerne donc un matériau utilisable comme armature de renforcement de revêtements d'étanchéité bitumineux, ledit matériau étant du type constitué par une nappe fibreuse non tissée et étant caractérisé par le fait que ladite nappe est formée d'un complexe comportant trois couches de fibres superposées, liées entre elles, les couches externes étant à base de fibres de verre discontinues et la couche intermédiaire étant constituée par un non-tissé en polyester, l'ensemble des couches ainsi associées étant lié

chimiquement par une matière collante de type connu compatible avec le bitume. De préférence, la couche interne à base de polyester est un non-tissé réalisé à partir de filaments continus, relativement compact et de faible épaisseur, les fibres de verre des couches externes étant quant à elles, avant imprégnation de l'ensemble par la matière liante, à l'état pratiquement libre sans liaison entre elles.

De plus, la nappe interne en polyester a un poids égal au plus à la moitié de celui des nappes de verre.

Les différentes couches peuvent, avant imprégnation avec la matière liante, être soit simplement superposées les unes sur les autres, soit, éventuellement, liées entre elles par tout moyen connu tel que collage, aiguilletage, couture.

L'invention et les avantages qu'elle comporte seront cependant mieux compris grâce à l'exemple de réalisation donné ci-après à titre indicatif mais non limitatif.

Sur une installation conventionnelle permettant de superposer des nappes non tissées, on associe un non-tissé polyester pesant 70 grammes par mètre carré entre deux nappes de fibres de verre pesant au total 150 à 160 g/m^2. Les nappes ainsi superposées passent entre des cylindres d'entraînement pour être imprégnés plein bain dans une composition de colle de type styrène butadiène. Après imprégnation et exprimage entre des rouleaux, le complexe formé passe dans un four provoquant le sèchage de la colle.

Le complexe ainsi réalisé est alors revêtu d'une couche de bitume permettant d'obtenir un matériau d'étanchéité ayant une épaisseur de quatre millimètres.

Il présente d'excellentes caractéristiques, tant d'un point de vue stabilité dimensionnelle que de résistance au poinçonnement dynamique et au poinçonnement statique le rendant particulièrement approprié pour l'utiliser comme revêtement d'étanchéité monocouche.

Par ailleurs, le complexe textile de base peut facilement être stocké et manipulé, ce qui présente un avantage certain étant donné, qu'en général, le revêtement de bitume est réalisé par d'autres industriels que ceux fabriquant les armatures de renforcement.

Bien entendu, l'invention n'est pas limitée à l'exemple de réalisation décrit précédemment mais elle en couvre toutes les variantes réalisées dans le même esprit.

REVENDICATIONS

1/ Matériau utilisable comme armature de renforcement de revêtements d'étanchéité bitumineux, matériau du type constitué par une nappe fibreuse non tissée, caractérisé par le fait que ladite nappe est formée d'un complexe comportant trois couches de fibres superposées, liées entre elles, les couches externes étant à base de fibres de verre discontinues et la couche intermédiaire étant constituée par un non-tissé en polyester, l'ensemble des couches ainsi associées étant lié chimiquement par une matière collante compatible avec le bitume.

2/ Matériau selon la revendication 1, caractérisé par le fait que la couche interne à base de polyester est un non-tissé réalisé à partir de filaments continus, relativement compacts et de faible épaisseur, les fibres de verre des couches externes étant quant à elles, avant imprégnation de l'ensemble dans la matière liante, à l'état pratiquement libre sans liaison entre elles.

3/ Matériau selon l'une des revendications 1 et 2, caractérisé par le fait que la nappe interne en polyester a un poids égal au plus à la moitié de celui des nappes de verre.

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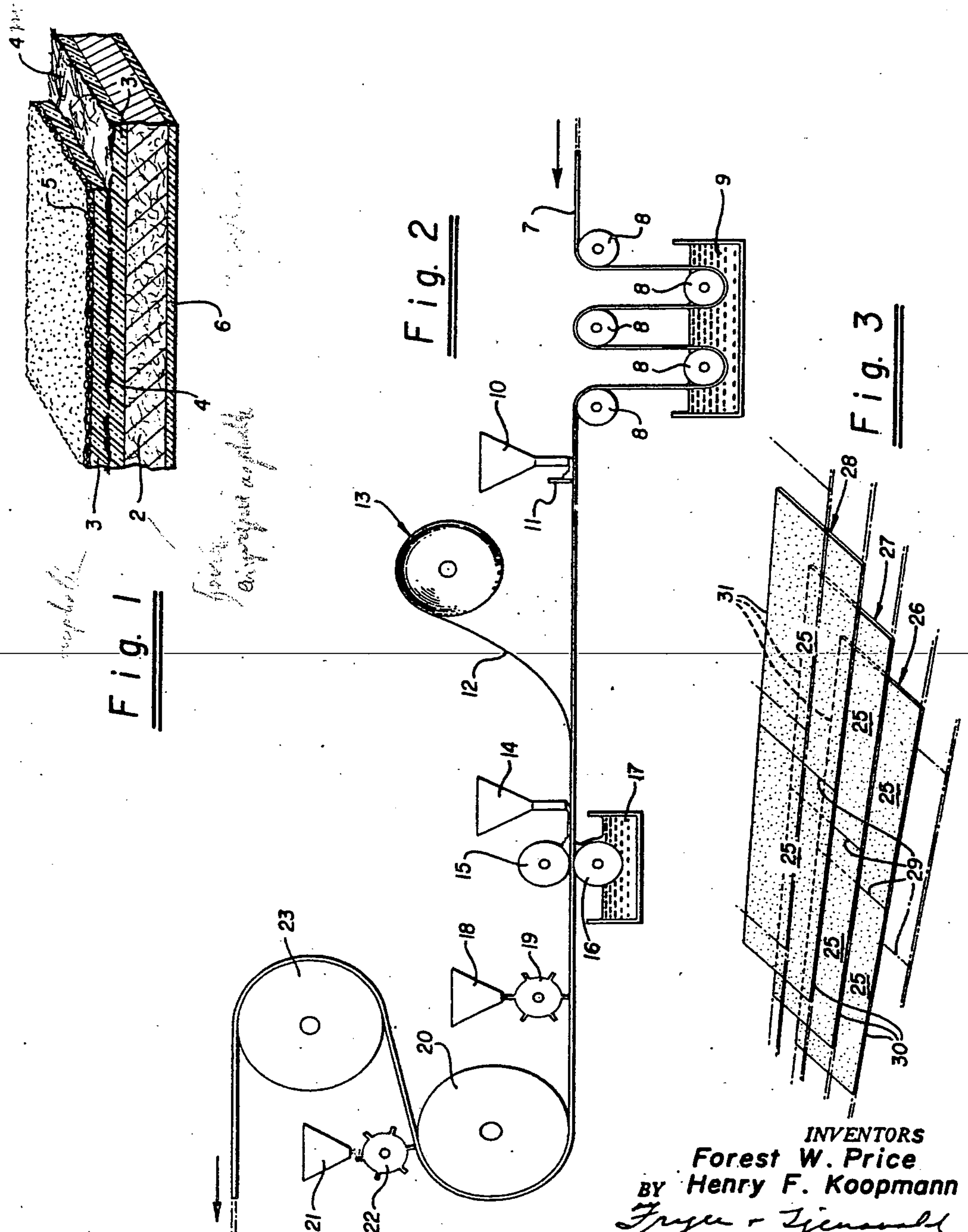
July 6, 1965 F. W. PRICE ETAL 3,193,439

FIRE RESISTANT ASPHALT ROOFING AND METHOD OF MANUFACTURE

Filed June 15, 1961



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FIRE RESISTANT ASPHALT ROOFING AND METHOD OF MANUFACTURE

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This invention relates to a fire resistant asphalt roofing material, and more particularly to an asphalt roofing of improved fire resistance.

Conventional asphalt roofings include a felt base which is saturated with asphalt, an asphalt coating above and below the asphalt saturated felt base, and a top layer of mineral surfacing. Such roofings have a long life, excellent resistance to all types of weather conditions, and they are relatively low in cost. However, they provide only limited protection against fire. When such roofings are exposed to fire, the asphalt coating becomes molten, it catches fire, and begins to flow down the roof slope. The flow of asphalt exposes fresh asphalt as well as the felt base to the flame thereby enabling the fire to burn rapidly through the roof.

In accordance with this invention, an asphalt roofing having greatly improved fire resistant properties is provided by a roofing which has an asphalt saturated organic felt base, an asphalt coating layer above the felt base, and glass fiber reinforcing elements in the asphalt coating which inhibit its flow at elevated temperatures. The use of an asphalt coating in such a roofing which forms a scum when it is subjected to fire provides an amazing increase in the fire resistance of the roofing. This roofing material may be employed either in the form of shingles or roll roofing.

The glass fibers tend to immobilize the upper asphalt coating when it is subjected to fire and thus greatly improve the fire resistant properties of the roofing. The combination of the glass fiber reinforcement hereof with an asphalt coating which forms a scum when it is subjected to fire provides surprising improvement in fire resistance even compared to a roofing which has either the glass fiber reinforcement or scum forming asphalt, but not both. When the roofing which includes the scum forming asphalt is subjected to a flame, the upper part of the asphalt coating forms a scum which provides an insulating barrier between the flame and the remainder of the asphalt coating, as well as the saturated felt below the scum. The glass fiber reinforcement immobilizes the scum and keeps it from sliding away down the roof. If the scum is permitted to slide away and expose fresh asphalt, the fire burns succeeding layers of freshly exposed asphalt and the saturated felt base until the fire burns through the roofing or spreads over a wide area. However, when the scum is retained in place, the "coking" effect of the fire on the exposed stationary scum prevents the fire from being fed by the underlying roofing.

Glass fibers are employed to immobilize the asphalt coating layer since they do not burn away when subjected to heat or flame. Furthermore, the glass fiber reinforcement is employed in the form of an open textured layer, as hereinafter defined, and the glass fibers thus act as anchors and reinforcement to hold the "coked" insulating scum layer in place.

The roofing of this invention has a long life like conventional asphalt roofings since the saturated felt base serves as a reservoir of oily constituents which keep the roofing pliable for many years. The organic felt base gives wind and weather tear resistance, and resistance to failure caused by flexing not obtainable through the use of glass fiber and asphalt combinations alone. In addi-

tion, the felt base serves as a barrier which prevents the molten asphalt from running out through the bottom of the roofing when exposed to fire. Thus the glass fiber reinforcement and the felt base each serve different but essential purposes in the asphalt roofing of this invention.

In the drawings:

FIG. 1 is an enlarged fragmentary view of one of the many possible roofing variations embodying the principles of this invention, with a part of the upper asphalt coating broken away to expose the glass fiber reinforcement, and which for purposes of clarity is more or less schematic in illustrating the relative thicknesses of the various layers.

FIG. 2 is a schematic illustration of the method and apparatus which may be employed to manufacture the roofing of this invention.

FIG. 3 is a perspective view of a preferred section of the roofing hereof in which the roofing is in the form of shingles.

In greater detail and with particular reference to FIG. 1, the roofing has an asphalt saturated felt base or layer **2**, an upper asphalt coating **3**, a continuous open textured layer of glass fibers **4** within the upper asphalt coating **3**, a top coating of mineral granules or other suitable mineral surfacing **5**, and a bottom asphalt coating **6**.

Any conventional felt base used in the roofing field may be employed in the roofing hereof. Such felt bases or foundation layers are generally composed of organic fiber stock, such as vegetable, animal and synthetic fibers. A felt which weighs between about 1 and 30 pounds per hundred pounds of roofing, or in other words which is between about 1 and 30 percent by weight of the roofing, provides best results. If the felt base is below about 1 percent by weight of the roofing, the roofing loses much of its durability since the felt serves as the reservoir for the asphalt saturant constituents which keep the roof pliable. On the other hand, if the felt is more than about 30 percent by weight of the roofing, the character of the felt is no longer smooth and its contains clots of fibers. This heavy type of felt cracks easily and causes a substantial reduction in the extent to which the roofing may be flexed without breakage.

As previously mentioned, the felt base adds to the desired fireproofing qualities of the roofing, since in case of fire it restrains the molten upper layer of asphalt coating from running through the roofing material. In other words, the felt aids the glass fiber layer in immobilizing the asphalt coating mass in place when the roofing has been subjected to fire.

Any suitable asphalt saturant may be employed to saturate the felt base. Such saturants are conventionally used in roofings to waterproof the felt and provide a reservoir of plasticizing constituents which give the roofing a long life. The asphalt saturant is generally prepared by air blowing an asphalt having a softening point between 50° F. and 110° F. until it has a softening point of between about 110° F. and 145° F. as measured by ASTM ring and ball test method D–36, but this procedure is not essential since equivalent asphaltic materials may be employed.

Between about 1 and 50 percent by weight of the roofing hereof is composed of asphalt saturant. If the amount of saturant is substantially below about 1 percent by weight of the roofing, it is insufficient to adequately waterproof the felt and provide a roofing of long life. If too much saturant is employed so that it exceeds about 50 percent by weight of the roofing, the felt is unable to absorb all of the saturant and the excess saturant tends to bleed into and modify the harder asphalt coating. This causes the asphalt coating to soften under the heat of the sun. Also, an excess of asphalt saturant may exude through the bottom of the roofing at the usual tempera-

tures which are encountered on roofs, and then run down into the house.

An upper asphalt coating is formed on the belt base. As previously mentioned, an asphalt which has the characteristic of forming a scum when it is subjected to a flame provides surprising fire resistant properties to the roofing. In the usual asphalt which does not inherently have scum forming property, it has been found that the inclusion of a Friedel-Crafts type catalyst in any asphaltic composition equivalent to those used in the roofing industry will impart this very important property. Examples of such catalysts include ferric chloride, aluminum chloride, and tin chloride as well as the other well known Friedel-Crafts type catalysts.

When a Friedel-Crafts catalyst is employed to impart the scum forming characteristic, the asphalt coating is desirably formed by air blowing the asphalt together with the Friedel-Crafts catalyst. For example, the catalyst may be added to the commercial asphalt which generally has a softening point of between about 50° F. and 110° F. as determined by ASTM ring and ball test method D-36. This asphalt mixture is air blown at a temperature between about 380° F. and 650° F., and the blowing is continued until the asphalt has a softening point by the Ring and Ball method of between about 180° F. and 250° F. Other equivalent means of providing scum-forming properties may be employed such as adding the catalyst to previously blown coating. Generally, if the coating has a softening point of less than 180° F., it is so soft that it tends to melt under the sun. Asphalt coatings which have a softening point above about 250° F. are too brittle and tend to crack when flexed.

A finely ground mineral stabilizer is usually incorporated in the upper asphalt coating in order to stabilize the coating when it is subjected to heat or fire and also to improve durability of the roofing. Suitable stabilizers include ground limestone, feldspar and mica as well as many others well known to those familiar with the art. The amount of stabilizer in the coating may vary widely from about zero to about 70 percent by weight of the total weight of asphalt and stabilizer in the coating. For best results, about 45 to 55 percent by weight of the coating should be composed of the mineral stabilizer. The mineral stabilizer in the coating usually raises the softening point of the asphalt between about 2° F. and 25° F.

In addition the mineral stabilizer usually decreases the penetration of the asphalt coating as determined by ASTM test D-5. The asphalt without the stabilizer has a penetration of between about 13 and 25, whereas the mineral stabilized asphalt coating has a penetration of between about 10 and 23. These penetration figures for the asphalt coating layer are to be contrasted with the penetration tests of the asphalt saturant used for saturating the felt base. The asphalt saturant has a penetration of between about 40 and 120 as determined by ASTM test D-5. Penetration can be considered a measure of the brittleness of the asphalt coating, and can indicate the amount of plasticizing oil which is present.

Viscosity measurements set forth in the following Table A also illustrate differences between the asphalt used as a saturant and the asphalt in the coating:

Table A

Temperature, ° F.	Viscosity, Centipoises	
	Saturant	Coating
355	40	900
375	32	480
400	26	265
430	22	160

The amount of ferric chloride or other Friedel-Crafts catalyst employed in the upper asphalt coating may vary anywhere from between about 0.1 and about 10.0 percent by weight based on the weight of the asphalt without the mineral stabilizer. A range of from about 0.2 percent to 0.9 percent by weight of Friedel-Crafts catalyst is optimum and provides best results in providing the desired scum on the asphalt coating when it is subjected to a fire.

The stabilized upper asphalt coating containing the ground mineral comprises between about 15 and 90 percent by weight of the roofing. No additional improvements are obtained when the weight of the upper asphalt coating is increased to more than about 90 percent by weight of the roofing. If the roofing contains less than 15 percent by weight of the mineral stabilized upper asphalt coating, there is not enough of the coating material to provide a continuous effective protecting coating. Furthermore, the top layer of mineral granules do not adhere to a very thin coating layer, and thus the roofing becomes impractical when the coating is less than about 15 parts by weight of the roofing.

An open-textured, substantially continuous discrete layer of glass fiber reinforcement is located in the upper asphalt coating. In this connection, the glass fiber reinforcement may be entirely within the asphalt coating or it may be adhered to the asphalt saturated felt base by the top coating or it may be adhered to the top surface of the upper asphalt coating. These glass fiber reinforcements perform the important function of retaining and immobilizing the asphalt when the roofing is subjected to fire. As previously described, the roofing is particularly resistant to fire when the glass fiber reinforcement is used to immobilize asphalt of the type which is formed into a scum by fire. The open texture of the glass fiber reinforcement is of great value in retaining the scum in place, and preventing it from sliding down the roof. Furthermore, the use of glass fiber reinforcement insures that the fire will not burn through the roofing. It is not necessary that the entire roofing contain the glass fiber reinforcement, but it is important that the portion of the roofing which is exposed in an installed roofing have the open-textured glass fiber reinforcement layer defined herein in order to immobilize the asphalt coating.

Thus when the roofing is subjected to fire and the scum is formed, the open-textured layer of glass fibers immobilizes the scum, and the immobilized scum serves as an insulating layer for the lower portions of the shingle. It is thus apparent that the roofing hereof contains an open-textured glass fiber reinforcement which is not composed of small loose particles disposed in the asphalt coating that could float away with the molten asphalt, but instead which are anchored in the roofing and in turn anchor the scum.

As used herein, the term open-textured, substantially continuous, layer of glass fibers means any arrangement of glass fibers which extends substantially continuously across the exposed portion of the roofing element either in substantially continuous interlocking or connected arrangement, or in substantially continuous strands or elements which are disposed in a layer but which are not necessarily interconnected to each other. Such layer arrangement insures that the glass fibers will anchor any localized area of asphalt exposed to fire through the portion of fiber reinforcement anchored in solid asphalt. Examples of such reinforcement layers which may be employed are commercial prefabricated glass mats, glass mats formed at the roofing machine, glass fiber scrims, porous glass cloth, glass fiber disposed in a random swirl, and longitudinally arranged glass threads. Since the glass fibers disposed in a random swirl and the longitudinally arranged glass threads are direction in extent, such layers are affixed to the roofing so that the fibers and threads extend across the roofing in a direction generally across the slope of the roof. The random glass fiber swirl and the longitudinally arranged glass threads or strands may be spaced apart and not connected, and yet they form the substantially continuous layer hereof.

The open-textured layer of glass fiber reinforcement may comprise between nearly zero percent and 3 percent

by weight of the weight of the roofing. If the glass fiber reinforcement employs threads which are too thin, the threads will not have enough strength and capacity to hold the scum in place when the shingle is subjected to fire. Glass fiber scrims and longitudinal layers of glass fiber threads are effective even when they comprise less than about 0.05 percent and nearly zero percent by weight of the roofing.

The roofing is desirably provided with a top finish that provides color and texture, and protects the roofing against the action of the sun and the weather. Any suitable finish may be employed, such as conventional mineral granules, sand, and mica. Depending upon the type of finish, it may comprise between about 0.5 percent and 70 percent by weight of the roofing. When large roofing granules are used, the finish may comprise a substantial part of the weight of the finish. Fine sand or dusting applied as a finish is an example of a finish that does not weigh very much.

A lower protective coating may be applied to the felt. However, this coating is not an important factor in the fire resistance and can be of the type generally used in the industry, can be left off entirely, or can be replaced by other fire resistant sealants without seriously affecting the improved performance of this roofing. When such coatings are employed, asphalt coatings are generally used. This lower coating may vary from between about 0 and about 8 percent by weight of the weight of the shingle. If more than about 8 percent by weight of the roofing is composed of the bottom coating of asphalt, the roofing tends to blister under normal use.

The bottom asphalt coating on the roofing may advantageously be covered with a layer of dust to render the back of the roofing non-tacky, although this is not essential. A fine mineral dust or mica may be employed for this purpose and the amount may vary between 0 percent by weight to about 10 percent by weight of the weight of the roofing material.

The range of the components used in the roofing is set forth in the following table:

TABLE B

	Percent by weight
Top surfacing	0.5 to 70
Upper asphalt coating	15 to 90
Glass fiber layer	0.0001 to 3
Felt	1 to 30
Asphalt saturant for felt	1 to 50
Lower asphalt coating	0 to 8
Dust	0 to 10

A variety of methods may be employed for placing the glass fiber layer in the roofing material and for preparing the roofing. For example, one method of manufacturing the shingle is schematically illustrated in FIG. 2. The felt 7 guided by rollers 8 passes through an asphalt saturant bath 9 to form the asphalt saturated felt 2 illustrated in FIG. 1.

Next, a first application of the upper asphalt coating is made on the saturated felt by asphalt flowing through applicator 10 although this step is not always necessary. A vertical scraper bar 11 uniformly distributes the asphalt coating on top of the saturated felt base as it passes beneath bar 11.

The glass fiber reinforcement in the form of glass mat, reels of thread, glass cloth, or a scrim of glass fibers 12, is unrolled from a roll 13, and deposited on the top of the base to provide the open-textured, continuous layer of glass fibers 4 in the roofing. Next, when desired, an application of the upper asphalt coating is made on top of glass fiber reinforcement 12 through applicator 14 so that the asphalt coating 3 will be above and below the glass fiber layer in the roofing. This application of asphalt coating is metered and evenly distributed by roll 15.

The lower coating of asphalt 6 may be applied to the felt by applicator roll 16 which has its bottom portion in coating bath 17. As the roofing passes over roll 15, the roll rotates and carries the lower coating of asphalt to the bottom of the saturated felt base 2.

As the roofing travels onward, the top layer of mineral surfacing 5 is applied on the upper asphalt coating from hopper 18. Ribbed distribution roll 19 provides a uniform layer of mineral surfacing 5 on the roofing. In accordance with the method of this particular example, dust is applied to the back of the roofing by means of hopper 21 and ribbed distribution roll 22 as the roofing winds around large guide rolls 20 and 23 to complete formation of the roofing material.

The temperature of asphalt saturant bath 9 is generally between about 350° F. and 600° F., with the average temperature being about 400° F. The temperature of the coating layer asphalt deposited by applicators 10, 14 and 16 may vary between about 300° F. and about 450° F. with the average temperature being about 370° F. The temperature of the molten asphalt used to provide coating layers 3 and 6 is relatively low considering the high melting point and viscosity of the asphalt which is employed. A low temperature is desired so that the coatings will be viscous when they are applied and stay at the location on which they are deposited. On the other hand, the saturant temperature is maintained relatively high considering the low melting point of the saturant so that the saturant will thoroughly saturate and coat all of the felt fibers in the felt base 2 of the roofing.

The weight of the roofing prepared in accordance with this invention may effectively vary between about 15 and about 140 pounds per factory square, which is 108 square feet. A weight of about 108 pounds per factory square is preferred. If the weight falls substantially below about 15 pounds per factory square of roofing, the roofing becomes too light to be serviceable and durable. On the other hand if the weight is substantially in excess of 140 pounds per factory square of roofing, the roofing material becomes too heavy and provides a load greater than is desirable in most houses.

The resultant roofing material may be applied as a roll roofing, or it may be cut up and utilized as shingles of any desirable design. Surprisingly, 12" x 36" strip shingles weighing 108 lbs, per factory square of roofing, have passed the Class A Underwriters' tests for fire resistance. In this connection, it is not necessary to employ the glass fiber reinforcement over the entire surface area of the shingles, but only over the area which is exposed when the shingles are laid. The usual saturated felt base asphalt shingles have not been able to even approach passing the Class A first test. Attempts to improve the fire resistance of such shingles have generally involved the addition of expensive and heavy materials, such as vermiculite layers, with or without very heavy layers or addition of asbestos fibers. The substantial amounts of vermiculite and asbestos renders such shingles unduly heavy and restricts their use to very sturdily constructed buildings which can withstand the load.

A particularly advantageous roofing construction which utilizes the shingle hereof is shown in FIG. 3. In this roofing shingles 25 are employed which are preferably three times as long as their width. A 12 inch by 36 inch shingle has proven to be particularly desirable. These shingles 25 do not have cut-outs, and therefore provide much greater resistance to fire than shingles which contain cut-outs.

The roofing illustrated in FIG. 3 is formed of courses 26, 27, and 28 of rectangular shingles 25. The shingles 25 as laid on the roof have side edges 29, lower edges 30 and upper edges 31. Lower edges 30 of shingle 25 in course 27 lie intermediate between the upper and lower edges 31 and 30 in underlying course 26. Similarly, lower edges 30 of the shingles in course 28 are intermediate between the upper and lower edges of shingles in underlying course 27. In addition the side edges 29 of shingles 25

in each overlying course are spaced from the side edges of the underlying course. The effect of this arrangement is to provide a stepped pattern of shingles.

In a preferred roofing which contains rectangular shingles 12 inches wide by 36 inches long, a 5 inch space is exposed from the lower margin of the underlying shingle leaving 7 inches of the upper portion of the shingle covered. In addition the upper courses are stepped from the side of the underlying courses preferably by about 5 inches. This arrangement provides at least a double thickness of shingles for all areas of the roofing and spaced 2 inch strips having a triple thickness of shingle.

The following are examples of the preparation of roofings in accordance with the present invention:

Example 1

An asphalt saturated organic fiber felt is coated with ferric chloride catalyzed, oxidized, California base petroleum asphalt containing 55 percent mineral filler.

A layer of 0.9 pounds per factory square glass mat is then laminated to the saturated felt by the coating. Standard No. 11 size granules surface the sheet in the conventional manner. The back of the sheet is asphalt coated and dusted with mineral surfacing in the usual manner.

The roofing has the following components in percent by weight:

Mineral granules	32
Upper filled and catalyzed asphalt coating	34
Glass mat	0.9
Felt	12.1
Asphalt saturant for felt	17
Lower asphalt coating	3
Dust	1

Next shingles are cut from the roofing in 12 inch by 36 inch strips, having no tab cut-outs. The shingles are then laid in rows with ends butting and with a 7 inch overlap for succeeding courses. The weight of the shingle is about 108 pounds per factory square.

This shingle was tested by the Underwriters' Laboratories and passed the Class A fire resistance tests to qualify for the Class A labeling service. In accordance with the standard procedure in making these tests, this shingle roofing was subjected to the flame exposure test, the spread-of-flame test and the burning brand test. For the flame exposure and burning brand tests a test deck 3½ feet wide by 4⅓ feet long made of kiln-dried white pine lumber, and the shingle roofing hereof was installed on the deck. For the spread-of-flame test, the test deck was constructed in the same manner and covered by the shingles set up in the arrangement shown in FIG. 3, except that the deck was 3⅓ feet wide and 13 feet long.

In all of the tests the decks were subjected to an air current which flows uniformly over the top structure of the roof covering, and the velocity of the air current was about 12 miles per hour. The decks were inclined during the tests at a slope of 5 inches per horizontal foot.

In the flame exposure test the test deck was subjected to a luminous gas flame which uniformly bathed the top surface of the shingles except for the two upper corners. The flame developed a temperature of about 1,400° F. and the deck below the roofing did not ignite even though the flame was consecutively left on for 2 minutes and off for 2 minutes for 15 test cycles.

In the spread-of-flame test, the gas flame described in the flame exposure test was permitted to be applied continuously for 10 minutes, and the wooden deck below the shingles hereof did not catch fire.

The Class A burning brand test was also passed by the roofing hereof with the shingles arranged as shown in FIG. 3. A grid of 12 inches square and approximately 3 inches thick made of kiln dried douglas fir lumber free from knots and pitch pockets and weighing about 2,000 grams was ignited to burn freely. The burning brands

were then placed on the surface of the test deck and permitted to burn themselves out. Such brands did not cause the underlying deck to catch fire, nor did any portion of the roof covering material blow or fall off the test deck in the form of flaming or glowing brands in any of the foregoing three tests. The flaming in the spread-of-flame tests did not spread beyond 6 feet, and therefore the roofing passed the Class A tests.

Example 2

A roofing is prepared in the manner set forth in Example 1 except that a layer of .9 pound per factory square of glass mat is laminated to the saturated felt by the coating and covers the exposed 5 inches of the shingle and about 2 inches of the unexposed portion of the shingle. In addition large minus 6 mesh granules are used to surface the sheet. The roofing is cut into shingles in the same manner as in Example 1 and applied to a roof by the procedure described in such example. The weight of the shingle is approximately 135 pounds per factory square.

This shingle passes all Underwriters' Class B tests, and two out of three Class A tests.

Example 3

Another roofing manufactured in accordance with this invention is prepared by laminating a layer of glass mat having a weight of 0.9 pound per factory square to a saturated felt base. The glass mat covers the exposed 5 inches of the final shingle and over 1 inch of the unexposed portion of the shingle.

An upper asphalt coating of Venezuelan high flash oxidized petroleum asphalt is employed for laminating the glass mat to the asphalt saturated fiber base. The asphalt coating contains approximately 55 percent by weight of mineral filler. The coated felt is then surfaced with minus 6 mesh granules. Next the back of the sheet is asphalt coated and dusted with mineral surfacing in the usual manner. Shingles are cut from the roofing in 12 inch by 36 inch strips having no tab cut-outs. The shingles are applied to the roof in courses with ends butting and in a stepped arrangement with a 7 inch head lap for succeeding courses.

The weight of the shingle is about 135 pounds per factory square. This shingle shows greatly improved fire resistance as compared to a similar shingle which does not contain the glass fiber mat.

Example 4

An asphalt saturated organic fiber felt is coated with ferric chloride, catalyzed, oxidized, California base petroleum asphalt containing 55 percent by weight mineral filler. A layer of glass scrim approximately ⅛ inch by ⅛ inch to 1 inch by 1 inch covering the entire exposed portion of the shingle and most of the unexposed section is laminated to the saturated felt by the surface coating. The roofing is completed and formed into shingles in the same manner as in Example 1. This roofing also shows a surprising resistance to fire.

Example 5

A roofing is prepared using the components and procedure described in Example 1. However, instead of employing a glass mat as the continuous open-textured layer of glass fibers, continuous strands of glass fiber in parallel, straight lines are placed on the saturated felt and adhered to the felt by the surface coating. The strands are present in an amount of 0.01 pound per factory square.

This roofing also demonstrates superior resistance to fire, and the glass fiber strands immobilize the scum when it is subjected to fire.

We claim:

1. A fire resistant asphalt roofing which comprises a felt base of organic fibers saturated with a first asphalt, a coating layer above the felt base of a second asphalt hav-

ing a softening point above that of the first asphalt and which forms a scum when subjected to fire, and an open-textured substantially continuous layer of glass fibers united to the asphalt coating, said layer of glass fibers having substantial apertures therein which extend through said layer of glass fibers and which are filled with asphalt from said asphalt coating layer.

2. A fire resistant asphalt roofing in accordance with claim 1 in which the first asphalt has a softening point between about 110° F. and 145° F. and the second asphalt has a softening point between about 180° F. and 250° F.

3. The roofing of claim 1 wherein said asphalt coating layer comprises an air blown asphalt containing a Friedel-Crafts catalyst.

4. The roofing of claim 1 wherein said asphalt coating layer contains up to 70 percent by weight finely divided mineral stabilizer and from .1–10 percent by weight ferric chloride catalyst.

5. The roofing of claim 1 wherein said layer of glass fibers is a glass fiber mat.

6. The roofing of claim 1 wherein said layer of glass fibers is a glass cloth.

7. The roofing of claim 1 wherein said layer of glass fibers is a glass scrim.

8. The roofing of claim 1 wherein said layer of glass fibers is composed of a plurality of spaced strands of glass fiber disposed in substantially parallel relationship.

9. The roofing of claim 1 wherein said layer of glass

fibers is composed of glass fiber disposed in a random swirl.

10. A fire resistant asphalt roofing which comprises a felt base of organic fibers saturated with a first asphalt, an upper coating layer of a second asphalt above the felt base, said second asphalt having a softening point higher than said first asphalt and containing from about 0.1 to 10 percent by weight ferric chloride based on the weight of asphalt in said upper coating, an open-textured substantially continuous layer of glass fibers within the upper coating, and a lower asphalt coating below the felt base, said layer of glass fibers comprising between about 0.0001 and 3 percent by weight of said roofing, and having substantial apertures therein which extend through said layer of glass fibers and which are filled with asphalt from said upper asphalt coating layer.

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